Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	43	(conducting adj polymer) same (photosensitive)	US-PGPUB; USPAT	OR	ON	2005/07/13 08:18
L2	31	1 and @ad<"20010919"	US-PGPUB; USPAT	OR	ON	2005/07/13 08:46
L3	12	(conducting adj polymer) same (lithographical$2)	US-PGPUB; USPAT	OR	ON	2005/07/13 08:47
L4	7	3 and @ad<"20010919"	US-PGPUB; USPAT	OR	ON	2005/07/13 08:17
L5	0	(conducting adj polymer) same (lithographical$2)	USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/13 08:18
L6	11	(conducting adj polymer) same (photosensitive)	USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/13 08:18
L7	482	(three adj dimensional) and (conducting adj polymer) and @ad<"20010919"	US-PGPUB; USPAT	OR	ON	2005/07/13 08:46
L8	46	7 and (lithographical$2)	US-PGPUB; USPAT	OR	ON	2005/07/13 08:47

US-PAT-NO: 6452110

DOCUMENT-IDENTIFIER: US 6452110 B1

TITLE: Patterning microelectronic features without using photoresists

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Abstract Text - ABTX (1):

A method and structure for producing metallic polymer conductor lines comprising of an alternative methodology to a traditional damascene approach, called a cloisonne or inverse damascene approach. The cloisonne approach comprises the steps of coating a **photosensitive** polymer such as pyrrole or aniline with a silver salt on a semiconductor substrate. Using standard photolithography and resist developing techniques, the **conducting polymer** is exposed to a wet chemical developer, removing a portion of the exposed **conducting polymer** region, leaving only **conducting polymer** lines on top of the substrate. Next, an insulating dielectric layer is deposited over the entire structure and a chemical mechanical polish planarization of the insulator is performed creating the **conducting polymer** lines. Included in another aspect of the invention is a method and structure for a self-planarizing interconnect material comprising a conductive polymer thereby reducing the number of processing steps relative to the prior art.

Brief Summary Text - BSTX (14):

In order to attain the objects suggested above, there is provided, according to one aspect of the invention an alternative methodology for a damascene process. The present invention provides for a novel "cloisonne" or "inverse damascene" approach. In the cloisonne approach, the use of a **photosensitive conducting polymer,** which acts as both a masking and conducting layer, is employed. The advantage of the cloisonne approach is that it takes fewer processing steps to end up with a similar final structure produced by the damascene approach. Consequently, this reduction of processing steps reduces processing time and reduces overall costs in semiconductor manufacturing.

Brief Summary Text - BSTX (15):

More specifically, the cloisonne approach comprises the steps of coating a **photosensitive** polymer such as pyrrole or aniline with a silver salt on a semiconductor substrate. Then, using standard photolithography and resist

developing techniques, the **conducting polymer** is exposed to a wet chemical developer, which removes a portion of the exposed **conducting polymer** region, leaving only **conducting polymer** lines on top of the substrate. Next, an insulating dielectric layer is deposited over the entire structure and a chemical mechanical polish (CMP) planarization of the insulator is performed creating the **conducting polymer** lines. Another aspect of the present invention involves a method and structure for a self-planarizing interconnect material comprising a conductive polymer, thereby reducing the number of processing steps relative to the prior art. Here, the method for producing metallic polymer conductor lines comprises the steps of depositing a self-planarizing conductive polymer material on a substrate using a spin-on application, and then patterning the conductive polymer material using either lithographic and dry etch techniques or by exposing a **photosensitive** component of the conductor polymer.

Brief Summary Text - BSTX (16):

In the current disclosure, damascene structures are created with far fewer processing steps. Basically, with the present invention, a **photosensitive conducting polymer** film is deposited on a substrate. The conductor is then exposed and developed for forming conducting lines. An insulating layer is then deposited and polished by CMP back to the **conducting polymer,** resulting in an inverse damascene structure.

Detailed Description Text - DETX (10):

In FIG. 5, for the cloisonne approach, a **photosensitive conducting polymer** 200, such as pyrrole or aniline (with a silver salt as suggested in "Photolithographically-patterned electroactive films and electrochemically modulated diffraction gratings", Kirk S. S., Troy, S. Bergstedt, Brian T. H. and Carla S. P. Cavalaheiro, Langmuir, 2000, 16, p. 795-810; and U.S. Pat. No. 5,919,402 "Electronically **conducting polymers** with silver grains" issued to Murphy et al. incorporated herein by reference) is coated on a semiconductor substrate 100. However, in the prior art, there is no teaching of using the cloisonne approach to make multilevel structures and conducting polylines encapsulated by an insulating dielectric.

Detailed Description Text - DETX (15):

Conversely, FIG. 9 shows the depositing a **photosensitive conducting polymer** 200 in item 900. Then, in item 902, the exposure and development of the **conducting polymer** 200 occurs. Referring to item 904 the deposit of the insulator 20 is shown. And finally, in item 906, the CMP planarization of the insulator 20 occurs. As is clearly evident, the number of processing steps is far fewer in the cloisonne method compared to the damascene method, thereby

resulting in less processing time, and consequently reducing costs.

Claims Text - CLTX (1):

1. A method for producing metallic polymer conductor lines comprising: depositing a **photosensitive conducting polymer** on a substrate; exposing said **conducting polymer** with a patterned light source; developing said **conducting polymer** using a wet chemical developer to remove portions of said exposed **conducting polymer** regions; depositing an insulating layer; and planarizing said insulating layer.

Claims Text - CLTX (2):

2. The method of claim 1, wherein said **photosensitive conducting polymer** is one of pyrrole, aniline, and a silver salt.

Claims Text - CLTX (4):

4. The method in claim 1, wherein said **photosensitive conducting polymer** acts as its own mask.

Claims Text - CLTX (5):

5. The method in claim 1, wherein said **photosensitive conducting polymer** comprises a metallic polymer with a photoactive agent.

Claims Text - CLTX (6):

6. The method in claim 1, wherein said depositing of said **photosensitive conducting polymer** is performed before said exposing process.

Claims Text - CLTX (7):

7. A method for producing metallic polymer conductor lines comprising the steps of: depositing a self-planarizing conductive polymer material on a substrate using a spin-on application; depositing a **photosensitive conducting polymer** on a substrate; exposing said **conducting polymer** with a patterned light source; developing said **conducting polymer** using a wet chemical developer to remove portions of said exposed **conducting polymer** regions; depositing an insulating layer; and planarizing said insulating layer.

Claims Text - CLTX (8):

8. The method of claim 7, wherein said **photosensitive conducting polymer** is one of pyrrole, aniline, and a silver salt.

Claims Text - CLTX (10):

10. The method in claim 7, wherein said **photosensitive conducting polymer** acts as its own mask.

Claims Text - CLTX (11):

11. The method in claim 7, wherein said **photosensitive conducting polymer** comprises a metallic polymer with a photoactive agent.

Claims Text - CLTX (12):

12. The method in claim 7, wherein said depositing of said **photosensitive conducting polymer** is performed before said exposing process.

US-PAT-NO: 5753523

DOCUMENT-IDENTIFIER: US 5753523 A

TITLE: Method for making airbridge from ion-implanted conductive polymers

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Brief Summary Text - BSTX (6):
Conducting polymers, spun onto a variety of substrates, have been investigated as a potential means for producing electrical devices on alternative substrates, or for fabricating multiple levels of circuitry.

Brief Summary Text - BSTX (21):
Jenekhe and Tibbets have reported spacially selective enhancement of the conductivity of a ladder-type polymer, BBL. They discuss the production of small geometry conductive regions in this polymer by implantation through metal masks which have been micro-**lithographically** defined. Their experiments were conducted using freestanding thin films. Implanted films were not patterned on the substrate, and stability is not measured. Also, they teach the use of a highly thermally stable polymer to avoid damage due to sample heating during bombardment. See "Ion implantation doping and electrical properties of high-temperature ladder polymers", Journal of Polymer Science: Part B: Polymer Physics, volume 26, pp. 210-209 (1988).

Brief Summary Text - BSTX (24):
Considerable thermal stability is required because all spin-coating processes require a subsequent bake to evaporate solvent from the film. Unless the **conducting polymer** film can withstand the short-term bake temperatures of 100.degree.-150.degree. C., it will be destroyed during these solvent evaporation steps.

Brief Summary Text - BSTX (26):
Then, the developed pattern is transferred to the **conducting polymer** layer by plasma etching; during this process, the **conducting polymer** film must etch in a total time which is less than the etch time of the photoresist etch mask.

Brief Summary Text - BSTX (27):
The **conducting polymer** film could be exposed to any of the etchant solutions

listed in Table A, depending upon the subsequent required processing steps. Therefore, the more of these etchants that the film can withstand, the more desirable the film will be as an electrical device because such versatility allows compatibility with a wider variety of materials and processing procedures.

Brief Summary Text - BSTX (35):
For example, most conductive polymers rely on a chemical doping process to impart conductivity, which in turn renders the polymer susceptible to chemically interactive attack from solvents, acids, or bases. That is, polyaniline is doped by acidification; thus, aqueous basic developer solutions will cause dedoping. Polypyrrole, polyacetylene, and poly(phenylene vinylene) type classes of **conducting polymers** are doped using Lewis acids and therefore are not expected to be resistant to acids and bases. This is not to say that these materials cannot be patterned, but separate passivation steps must be added, which limit resolution. Even then, certain etchant steps involving strong acids and bases will irreversibly damage the films. Nevertheless, the ion-implanted films have been found to be much more inert than these other classes of conductive polymers.

Brief Summary Text - BSTX (39):
If desired, the patterning process can be extended to include the production of freestanding bridge structures and **three-dimensional** cavities.

Drawing Description Text - DRTX (2):
FIG. 1 is a cross-sectional view of a single ion-implanted **conducting polymer** resistor, referred to here as a "contact resistor", because the **conducting polymer** material remains in contact with the substrate. The features are numbered as follows: 11, implanted polymer layer; 12, metal electrical connections; 13, substrate.

Drawing Description Text - DRTX (3):
FIG. 2 is a diagram of a 16- element resistor array formed from **lithographically** patterned polymer films made conductive by ion implantation, with the following elements: 21, nitride insulation covering 22; 22, metal electrical connection; 23, patterned polymer resistor; 24, metal electrical connection.

Detailed Description Text - DETX (6):
The polymer is coated on the desired substrate as a solvent or water solution with percent solids ranging from 2% to 75%, depending upon the solubility in solution, the molecular weight, and the desired thickness. If

the film is to be **lithographically** patterned, the polymer solution should be filtered before use to remove particles; the extent of filtration depends upon the smallest feature size, and a filtration step in the range of 0.2 to 1 micrometer is standard. The polymers are applied to the substrate by any standard method which produces the required thickness and film quality (spincoating, spray coating, brushing, roller coating, casting, meniscus coating, or dipping). The preferred method is spincoating. The spin speed and polymer percent solids are adjusted to form the desired film thickness. The solvent is then evaporated, preferably by baking on a hot plate or in an oven at a temperature greater than 90.degree. C.

Detailed Description Text - DETX (7):
If the films are to be **lithographically** patterned on an inflexible and nonporous substrate, the film thickness is an important parameter. Films which are too thick do not have the improved solvent resistance, and they can blister during the photoresist baking steps. In addition, the film thickness influences parameters such as ambient stability. The preferred film thickness (before implantation) for 35-75 keV implants is less than two times the mean implant range. For a poly(styrene-co-acrylonitrile) film to be implanted with 50 keV nitrogen ions, the optimal thickness is in the range of 1000 to 3000 angstroms. During the implantation process, films lose from 10% to 75% of their original thickness due to densification and sputtering.

Detailed Description Text - DETX (14):
Appropriate metal leads can be patterned by a similar process to form the structures shown in FIGS. 1 and 2. Electrical contacts can consist of metals (such as nickel, copper, gold, titanium-tungsten, or the like), an inorganic semiconductor, or a **conducting polymer** or other methods of making electrical interconnections apparent to one skilled in the art.

Detailed Description Text - DETX (17):
The ion implanted **conducting polymer** devices have a variety of applications in the integrated circuit industry as resistors and other electrical components. Their steep resistance-temperature response makes them useful as miniature temperature sensors or temperature sensing arrays, or in other types of devices where resistance changes can be used to monitor temperature.